Chemical and Biomolecular Engineering

At Berkeley, graduate work in chemical and biomolecular engineering emphasizes the excitement of original research in frontier areas of applied science. Graduate students may pursue a PhD in Chemical Engineering, or they may apply to the Product Development concentration to obtain an MS in Chemical Engineering. While formal courses are necessary to provide scientific fundamentals and intellectual breadth, the primary characteristic of Berkeley's graduate experience is to participate in the quest for new knowledge. Graduate students and faculty collaborate as partners in scholarship, in learning, and in intellectual discovery.

Master's Program

Professional Degree in Product Development Program (MS)

The PDP is a graduate-level degree program whose central aim is to fill the unmet need at national and international levels for graduates of chemical engineering and related disciplines who have knowledge and field experience in the complex process of transforming technical innovations into commercially successful products. In the space of one calendar year, PDP graduates will gain exposure to real-world product development practices in a range of chemical process-intensive industries including biotechnology, microelectronics, nanoscience, and consumer products (concentrations within the program). The PDP does not require a research thesis, but students will find completing the extensive coursework and field study assignment challenging. By combining elements of advanced technical knowledge with focused business-related training, the PDP aims to fill a specific niche in the “choice space” of graduate education options for engineering graduates.

PhD Program

The PhD program is designed to enlarge the body of knowledge of the student and, more importantly, to discover and develop talent for original, productive, and creative work in chemical and biomolecular engineering. Breadth of knowledge and professional training are achieved through advanced course work. To develop the creative talents of the student, a paramount emphasis in the PhD program is placed on intensive research, a project on which students work closely with one or more members of the faculty.

PhD students may choose to add a designated emphasis (DE) to their program. A designated emphasis is a specialization, such as a new method of inquiry or an important field of application, which is relevant to two or more existing doctoral degree programs. Designated emphases open to students in this PhD program include Nanoscale Science and Engineering (NSE), Energy Sciences and Technology (DEEST), Communication, Computation and Statistics, Computational and Genomic Biology, and New Media.

M.S. in Bioprocess Engineering

The Master of Bioprocess Engineering (MBPE) (https://guide.berkeley.edu/graduate/degree-programs/bioprocess-engineering/) program is designed to provide students with a unique opportunity to integrate classroom fundamentals, hands-on laboratory applications, and heavy interaction with a range of biotechnology companies spanning the biopharmaceutical, industrial biotech, and food tech industries."

Admission to the University

Applying for Graduate Admission

Thank you for considering UC Berkeley for graduate study! UC Berkeley offers more than 120 graduate programs representing the breadth and depth of interdisciplinary scholarship. The Graduate Division hosts a complete list (https://grad.berkeley.edu/admissions/choosing-your-program/list/) of graduate academic programs, departments, degrees offered, and application deadlines can be found on the Graduate Division website.

Prospective students must submit an online application to be considered for admission, in addition to any supplemental materials specific to the program for which they are applying. The online application and steps to take to apply can be found on the Graduate Division website (https://grad.berkeley.edu/admissions/steps-to-apply/).

Admission Requirements

The minimum graduate admission requirements are:

1. A bachelor’s degree or recognized equivalent from an accredited institution;
2. A satisfactory scholastic average, usually a minimum grade-point average (GPA) of 3.0 (B) on a 4.0 scale; and
3. Enough undergraduate training to do graduate work in your chosen field.

For a list of requirements to complete your graduate application, please see the Graduate Division’s Admissions Requirements page (https://grad.berkeley.edu/admissions/steps-to-apply/requirements/). It is also important to check with the program or department of interest, as they may have additional requirements specific to their program of study and degree. Department contact information can be found here (https://guide.berkeley.edu/graduate/degree-programs/).

Where to apply?

Visit the Berkeley Graduate Division application page (http://grad.berkeley.edu/admissions/apply/).

Admission to the Program

Admission is granted by the University's Graduate Division on the recommendation of the department. Applicants generally are required to provide the following: evidence of superior performance in the last two years of undergraduate studie; and three letters of recommendation from professors or colleagues familiar with the applicant's academic and professional aptitudes. International students whose native language is not English must provide evidence of English language proficiency. The weight of evidence from all sources determines admission. Students do not need a master's degree to apply for a doctoral degree. Most applicants will have completed a typical undergraduate program in chemical engineering. However, admission may be granted to students with undergraduate degrees in a related discipline. In this case, necessary background courses in chemical engineering are taken as part of the program for the first year.

Curriculum

A total of 18 units of letter-graded graduate courses must be taken during residence in the graduate program. In the first semester, a minimum of 9 units must be obtained from the core chemical engineering courses in the areas of mathematics, thermodynamics, reaction engineering, and transport phenomena. In addition, students are required to take the CHM ENG 375 pedagogy course and two semesters in CHM ENG 300. Students should be registered full time with a minimum of 12 units. These include CHM ENG 299 and colloquium series CHM ENG 298.

Additional units must be obtained from graduate level or upper division elective courses so that the total number of units taken is 18. Students may take classes in other departments such as Engineering, Physics, Chemistry, etc. They are strongly encouraged to pursue additional courses of specific relevance to their thesis research and to explore other areas of technical, professional, or personal interest.

9 units: Chemical Engineering graduate core courses		
CHM ENG 230	Mathematical Methods in Chemical Engineering	3
CHM ENG 240	Thermodynamics for Chemical Product and Process Design	3
CHM ENG 244	Kinetics and Reaction Engineering	3
CHM ENG 245	Catalysis	3
CHM ENG 250	Transport Processes	3
CHM ENG 274	Biomolecular Engineering	3
9-12 units: Graduate or upper division electives		

Professional Master's with Product Development Concentration

The Master's PDP program places equal emphasis on advanced course work in new product development principles, specific industry practices, and the field study assignment. Successful completion of each of these elements is a prerequisite to graduation. The specific courses taken in the PDP program are selected in consultations between the student, the PDP executive director, and a faculty adviser. Upon entrance to the program, students will be required to declare an industry area specialization so that an appropriate academic schedule can be constructed. Students must complete a minimum of 28 units with at least 18 of those units from letter-graded courses which include a minimum of 12 units in graduate-level (i.e., 200 series) courses.

Specific coursework to pursue an industry track will vary based on the individual student's interests and the availability of course offerings in a given year.

For examples of representative curricula for each industry track, please visit:

http://chemistry.berkeley.edu/grad/cbe/pdp/graduation-requirements (http://chemistry.berkeley.edu/grad/cbe/pdp/graduation-requirements/)

M.S. in Chemical Engineering

We are currently not accepting applications for this program.

Chemical and Biomolecular Engineering

CHM ENG 230 Mathematical Methods in Chemical Engineering 3 Units

Terms offered: Spring 2025, Spring 2023, Spring 2022
The course aims to introduce a variety of mathematical and computational methods useful in solving research problems pertaining to chemical and biomolecular systems. The course covers a wide range of topics from linear algebra and matrices, differential equations, and stochastic methods. Even though the focus is primarily on analytical methods, most of the concepts will be demonstrated with computations and applications. The goal of the course is to ensure that the students are aware of a wide range of computational methods that can be useful in their research and to provide the students with sufficient background in applied mathematics that can be useful in reading the science and engineering literature.

Rules & Requirements

Prerequisites: Math 53 and 54 or equivalent; open to seniors with consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 236 Physics-Inspired Machine Learning 3 Units

Terms offered: Spring 2025, Spring 2024
Machine learning in the context of scientific problems is an exciting emerging area of research, and often requires the development of new methods that can incorporate and exploit the inductive biases and structure needed for such problems. There are also now numerous examples of concepts in physics historically influencing machine learning methods development more broadly. This course will give an overview of different physics-inspired machine learning methods, and the connections between concepts in physics (numerical methods, dynamical systems, symmetries, conservation laws) and machine learning.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 240 Thermodynamics for Chemical Product and Process Design 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Topics covered include molecular thermodynamics of pure substances and mixtures, interfacial thermodynamics, statistical mechanics, and computer simulations.

Rules & Requirements

Prerequisites: Math 53 and 54 or equivalent; 141 or equivalent; open to seniors with consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 244 Kinetics and Reaction Engineering 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Molecular processes in chemical systems, kinetics and catalysis. Interaction of mass and heat transfer in chemical processes. Performance of systems with chemical reactors.

Rules & Requirements

Prerequisites: 142 or equivalent; open to seniors with consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 245 Catalysis 3 Units

Terms offered: Spring 2025, Fall 2020, Spring 2019
Adsorption and kinetics of surface reactions; catalyst preparation and characterization; poisoning, selectivity, and empirical activity patterns in catalysis; surface chemistry, catalytic mechanisms and modern experimental techniques in catalytic research; descriptive examples of industrial catalytic systems.

Rules & Requirements

Prerequisites: 244 or Chemistry 223, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 246 Principles of Electrochemical Engineering 3 Units

Terms offered: Spring 2012, Fall 2010, Fall 2009
Electrode processes in electrolysis and in galvanic cells. Charge and mass transfer in ionic media. Criteria of scale-up.

Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 248 Applied Surface and Colloid Chemistry 3 Units

Terms offered: Spring 2025, Spring 2023, Spring 2020
Principles of surface and colloid chemistry with current applications; surface thermodynamics, wetting, adsorption from solution, disperse systems, association colloids, interacting electrical double layers and colloid stability, kinetics of coagulation, and electrokinetics.

Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 250 Transport Processes 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Basic differential relations of mass, momentum, and energy including creeping, laminar, and turbulent flow, boundary layers, convective-diffusion in heat and mass transfer, and simultaneous multicomponent mass and energy transport. Analytic mathematical solution of the equations of change using classical techniques including: separation of variables, similarity solutions, and Laplace and Fourier transforms.

Rules & Requirements

Prerequisites: Chemical & Biomolecular Engineering 150A, 150B; Mathematics 53 and 54, or equivalent; open to seniors with consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 256 Advanced Transport Phenomena 3 Units

Terms offered: Spring 2024, Fall 2020, Fall 2018
Formulation and rigorous analysis of the laws governing the transport of momentum, heat, and mass, with special emphasis on chemical engineering applications. Detailed investigation of laminar flows complemented by treatments of turbulent flow systems and hydrodynamic stability.

Rules & Requirements

Prerequisites: 230

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG C268 Physicochemical Hydrodynamics 3 Units

Terms offered: Spring 2017, Fall 2013, Fall 2011, Spring 2011
An introduction to the hydrodynamics of capillarity and wetting. Balance laws and short-range forces. Dimensionless numbers, scaling and lubrication approximation. Rayleigh instability. Marangoni effect. The moving contact line. Wetting and short-range forces. The dynamic contact angle. Dewetting. Coating flows. Effect of surfactants and electric fields. Wetting of rough or porous surfaces. Contact angles for evaporating systems.

Rules & Requirements

Prerequisites: A first graduate course in fluid mechanics sucs as 260A-260B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructor: Morris

Also listed as: MEC ENG C268

CHM ENG C270 Protein Engineering 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2010
An in-depth study of the current methods used to design and engineer proteins. Emphasis on how strategies can be applied in the laboratory. Relevant case studies presented to illustrate method variations and applications. Intended for graduate students.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructor: Tullman-Ercek

Also listed as: BIO ENG C219

CHM ENG 274 Biomolecular Engineering 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Fundamentals in biomolecular engineering. Structures, dynamics, and functions of biomolecules. Molecular tools in biotechnology. Metabolic and signaling networks in cellular engineering. Synthetic biology and biomedical engineering applications.

Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 275 Advanced Bioprocess Engineering 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course is designed for students interested in obtaining advanced training in bioprocess engineering for applications in the biopharmaceutical, industrial biotech, and food tech industries. Emphasis will be placed on integrated application of quality by design (QbD) framework, good manufacturing practice (GMP), statistical experimental design, and other advanced concepts addressing current industry needs.

Rules & Requirements

Prerequisites: CHMENG 170A, CHMENG 170B concurrent (or consent of instructor)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 275L Advanced Bioprocess Engineering Laboratory 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
This pilot-scale laboratory course is designed for students interested in obtaining advanced training in bioprocess engineering for applications in the biopharmaceutical, industrial biotech, and food tech industries. Featured equipment (and experiments) include: Sartorius ambr250 (design of experiments), ABEC 300L bioreactor (fermentation), Alfa Laval disc stack centrifuge (liquid-solid separation), Alfa Laval M20 filtration skid (tangential flow filtration), and GE ÄKTA Avant chromatography unit (protein purification).
Rules & Requirements

Prerequisites: CHMENG 170A, CHMENG C170L, CHMENG 170B concurrent (or consent of instructor)

Hours & Format

Fall and/or spring: 15 weeks - 8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 286 Fundamental Electrochemistry 3 Units

Terms offered: Summer 2025 First 6 Week Session
Electrochemistry is a field of science that describes the interrelation of chemical and electrical effects. Much of the field deals with describing how chemical changes are caused by the passage of electrical current or how the production of electrical current can be caused by chemical reactions. Electrochemists rely on a foundational understanding of chemical thermodynamics and electrostatics, chemical and electron-transfer kinetics, and mass-transport phenomena – each of which are treated and developed in this course in the context of electrochemical phenomena. Additional topics include electrochemical instrumentation, practical electrochemistry, and electrochemical impedance spectroscopy.
Rules & Requirements

Prerequisites: Graduate students in Chemistry, Engineering or Physics disciplines should be suitably prepared to enroll in CHMENG 286 but are recommended to review preparatory materials posted on the Center for Electrochemical Science, Engineering, and Technology website: https://electrochemistry.berkeley.edu/education

Hours & Format

Summer: 6 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 287 Electrochemical Device Engineering 3 Units

Terms offered: Summer 2025 Second 6 Week Session
Electrochemical engineering combines the study of charge transfer at electrode/electrolyte interfaces with the development of practical materials and processes. Electrochemical devices/reactors, their voltage and current distribution, mass-transport, hydrodynamics, geometry, and overall performance in terms of reaction yield, conversion efficiency, and energy efficiency are examined. Electrochemical energy storage (batteries and capacitors), energy conversion (low- and high-temperature fuel cells and electrolyzers), and metal plating and electrosynthesis devices are covered. Fundamental chemistry, physics, and engineering principles that govern device response are emphasized.
Rules & Requirements

Prerequisites: CHMENG 186/286 Advanced Electrochemistry Fundamentals

Hours & Format

Summer: 6 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 288 Electrochemical Projects Laboratory 3 Units

Terms offered: Summer 2025 Second 6 Week Session
Students work in teams to solve open-ended research and development projects in electrochemical science, engineering, and technology. The projects for the course come from industry partners, national laboratory partners, and academic research laboratories. This allows the students to develop skills solving unstructured problems representative of what they will face in their career. Example projects span electrolysis and fuel cells, interfacial electrochemistry, batteries, and electrosynthesis.
Rules & Requirements

Prerequisites: CHEMENG 186/286 Electrochemistry Fundamentals

Hours & Format

Summer: 6 weeks - 16 hours of laboratory per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 293C Curricular Practical Training Internship 0.0 Units

Terms offered: Prior to 2007
This is an independent study course for international students doing internships under the Curricular Practical Training program.
Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Summer: 8 weeks - 0 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

CHM ENG C294A Mechanics and Physics of Lipid Bilayers 3 Units

Terms offered: Fall 2017
Lipid bilayers constitute the membrane that encloses every animal cell and many of its interior structures, including the nuclear envelope, the organelles and the endoplasmic reticulum. This is a unique course devoted to modern developments in this exceptionally active field of research, ranging from models based on continuum theory to recent developments based on statistical mechanics.
Objectives & Outcomes

Student Learning Outcomes: To expose students to advanced current work on the mechanics and physics of lipid bilayers (a very active field of current research relevant to biomechanics and biophysics)

Rules & Requirements

Prerequisites: Mechanical Engineering 185 or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructor: Steigmann

Also listed as: MEC ENG C285E

CHM ENG 295B Special Topics in Chemical Engineering: Electrochemical, Hydrodynamic, and Interfacial Phenomena 2 Units

Terms offered: Fall 2011, Spring 2011, Fall 2010
Current and advanced study in chemical engineering, primarily for advanced graduate students.
Rules & Requirements

Prerequisites: Open to properly qualified graduate students

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 295K Design of Functional Interfaces 3 Units

Terms offered: Spring 2011, Spring 2005, Fall 2004
This course introduces students to the concepts and techniques involved in the design and physical characterization of advanced functional materials consisting of well-defined interfaces. Throughout the course, principles of supramolecular chemistry on solid surfaces are applied to functional systems. Materials with different connectivity and structure at the active site are compared for development of understanding. Specific topics include catalysis, separations, encapsulation, and biomedicine.
Rules & Requirements

Prerequisites: Graduate standing

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructor: Katz

CHM ENG 295N Polymer Physics 3 Units

Terms offered: Spring 2015, Spring 2010, Spring 2008
This course, which is based on Gert Strobl's book addresses the origin of some of the important physical properties of polymer liquids and solids. This includes phase transitions, crystallization, morphology of multiphase polymer systems, mechanical properties, response to mechanical and electric fields, and fracture. When possible, we will develop quantitative molecular models that predict macroscopic behavior. The course will address experimental data obtained by microscopy, light and neutron scattering, rheology, and dielectric relaxation.
Rules & Requirements

Prerequisites: 230 and 240

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 295P Special Topics in Chemical Engineering: Introduction to New Product Development 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
This course is part of the product development initative sponsored by the department of chemical engineering. It focuses on real-life practices and challenges of translating scientific discovery into commercial products. Its scope is limited in most circumstances to situations where some knowledge of chemical engineering, chemistry, and related disciplines might prove to be particularly useful. The course primarily uses case studies of real-world new product development situations to simulate the managerial and technical challenges that will confront students in the field. We will cover a wide range of topics including basic financial, strategic and intellectual property concepts for products, managing risk and uncertainity, the effective new product development team, the evolving role of corporate R&D, the new venture product company and the ethics of post-launch product management.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructor: Alexander

CHM ENG 295Q Special Topics in Chemical Engineering: Advanced Topics in New Product Development 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course is a part of the product development initiative sponsored by the department of chemical engineering. The course builds on the coverage in 295P of real-life practices of translating scientific discovery into commercial products. We will cover a wide range of advanced product development concepts including technology road maps, decision analysis, six sigma, product portfolio optimization, and best practices for field project management.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor. 295P recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructor: Alexander

CHM ENG 295S Special Topics in Chemical Engineering: Introduction to Experimental Surface Chemistry 3 Units

Terms offered: Fall 2015, Fall 2014, Spring 2011
This course is intended to introduce chemical engineering students to the concepts and techniques involved in the study of chemical processes at surfaces. Special emphasis will be placed on the chemistry of semiconductor surfaces. Topics to be covered include thermodynamics and kinetics of surfaces; crystal and electronic structures of clean surfaces (metals and semiconductors); adsorption and desorption; surface kinetics and dynamics including diffusion; dynamics of growth and etching; surface reaction models; a survey of modern surface analytical techniques including electron diffraction, auger electron spectroscopy, photoelectron spectroscopy, vibrational spectroscopy, scanning tunneling microscopy, and mass spectrometry.
Rules & Requirements

Prerequisites: 240 or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 295T Hard-Technology Innovation: Proof-of-Commercial Value Method 3 Units

Terms offered: Prior to 2007
This course is part of the Product Development Program initiative sponsored by the Department of Chemical and Biomolecular Engineering. The course builds on the coverage in Chemical Engineering 295P of real-life practices of translating scientific discovery into commercial products. In this course, we will cover a new risk-reduction methodology for bringing to market complex technical inventions that initially have a high risk profile that discourages investment for commercialization. The central learning objective in this course is: How might we utilize a new approach that would enable university-affiliated hard-tech innovators to sufficiently de-risk their venture propositions so that they become “fundable” by investors?
Rules & Requirements

Prerequisites: Instructor approval needed

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructors: Alexander, Joshi, Sciamanna

CHM ENG C295A The Berkeley Lectures on Energy: Energy from Biomass 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013
After an introduction to the different aspects of our global energy consumption, the course will focus on the role of biomass. The course will illustrate how the global scale of energy guides the biomass research. Emphasis will be places on the integration of the biological aspects (crop selection, harvesting, storage, and distribution, and chemical composition of biomass) with the chemical aspects to convert biomass to energy. The course aims to engage students in state-of-art research.
Rules & Requirements

Prerequisites: Biology 1A; Chemistry 1B or 4B, Mathematics 1B

Repeat rules: Course may be repeated for credit under special circumstances: Repeatable when topic changes with consent of instructor.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructors: Bell, Blanch, Clark, Smit, C. Somerville

Also listed as: BIO ENG C281/CHEM C238/PLANTBI C224

CHM ENG C295L Implications and Applications of Synthetic Biology 3 Units

Terms offered: Spring 2007
Explore strategies for maximizing the economic and societal benefits of synthetic biology and minimizing the risks; create "seedlings" for future research projects in synthetic biology at UC Berkeley; increase multidisciplinary collaborations at UC Berkeley on synthetic biology; and introduce students to a wide perspective of SB projects and innovators as well as policy, legal, and ethical experts.
Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructors: Arkin, Keasling

Also listed as: BIO ENG C230

CHM ENG C295R Applied Spectroscopy 3 Units

Terms offered: Fall 2023, Spring 2009, Spring 2007, Spring 2002
After a brief review of quantum mechanics and semi-classical theories for the interaction of radiation with matter, this course will survey the various spectroscopies associated with the electromagnetic spectrum, from gamma rays to radio waves. Special emphasis is placed on application to research problems in applied and engineering sciences. Graduate researchers interested in systematic in situ process characterization, analysis, or discovery are best served by this course.
Rules & Requirements

Prerequisites: Graduate standing in engineering, physics, chemistry, or chemical engineering; courses: quantum mechanics, linear vector space theory

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructor: Reimer

Also listed as: AST C295R

CHM ENG C295Z Energy Solutions: Carbon Capture and Sequestration 3 Units

Terms offered: Fall 2018, Spring 2017, Spring 2015, Spring 2014, Spring 2013

After a brief overview of the chemistry of carbon dioxide in the land, ocean, and atmosphere, the course will survey the capture and sequestration of CO2 from anthropogenic sources. Emphasis will be placed on the integration of materials synthesis and unit operation design, including the chemistry and engineering aspects of sequestration. The course primarily addresses scientific and engineering challenges and aims to engage students in state-of-the-art research in global energy challenges.

Rules & Requirements

Prerequisites: Chemistry 4B or 1B, Mathematics 1B, and Physics 7B, or equivalents

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

Instructors: Bourg, DePaolo, Long, Reimer, Smit

Also listed as: CHEM C236/EPS C295Z

CHM ENG 296 Special Study for Graduate Students in Chemical Engineering 1 - 6 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

Special laboratory and theoretical studies.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: The grading option will be decided by the instructor when the class is offered.

CHM ENG 298 Seminar in Chemical Engineering 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023

Lectures, reports, and discussions on current research in chemical engineering. Sections are operated independently and directed toward different topics.

Rules & Requirements

Prerequisites: Open to properly qualified graduate students with consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

CHM ENG 298B Seminar in Bioprocess Engineering 1 Unit

Terms offered: Fall 2025, Spring 2025, Fall 2024

Weekly seminar with industry partners invited to give presentations on bio-based research, technologies, equipment, processes, and/or products. Provides an interactive interface for students and the bioprocess industry. Offered Fall and Spring semesters.

Rules & Requirements

Prerequisites: CBE 170A and CBE 170B (can be taken concurrently)

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of seminar per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

CHM ENG 298C Colloquium in Chemical Engineering 1 - 2 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
Lectures, reports, and discussions on current research in chemical engineering.

Rules & Requirements

Prerequisites: Open to properly qualified graduate students with consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2-3 hours of colloquium per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

CHM ENG 299 Research in Chemical Engineering 1 - 12 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
Research.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-12 hours of independent study per week

Summer:
6 weeks - 2.5-30 hours of independent study per week
8 weeks - 1.5-22.5 hours of independent study per week
10 weeks - 1.5-18 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate

Grading: Letter grade.

CHM ENG 300 Professional Preparation: Supervised Teaching of Chemical Engineering 2 Units

Terms offered: Spring 2020, Spring 2019, Spring 2016
Discussion, problem review and development, guidance of large scale laboratory experiments, course development, supervised practice teaching.

Rules & Requirements

Prerequisites: Graduate standing, appointment as a Graduate Student Instructor, or consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

CHM ENG 375 Professional Preparation: Supervised Teaching of Chemical Engineering 2 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018
Discussion, problem review and development, guidance of large scale laboratory experiments, course development, supervised practice teaching.

Rules & Requirements

Prerequisites: Graduate standing, appointment as a Graduate Student Instructor, or consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/ Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

CHM ENG 602 Individual Studies for Graduate Students 1 - 8 Units

Terms offered: Fall 2019, Spring 2019, Fall 2018
Individual study in consultation with the major field adviser for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D.

Rules & Requirements

Prerequisites: Graduate standing in Ph.D. program

Credit Restrictions: Course does not satisfy unit or residence requirements for doctoral degree.

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Chemical & Biomolecular Engineering/Graduate examination preparation

Grading: Offered for satisfactory/unsatisfactory grade only.